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INFRASTRUCTURE SHARING IN TELECOMMUNICATIONS: FUNDAMENTAL AND ANALYSIS

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ABSTRACT

Telecommunications industry is playing a major role in developing in every countries. Since the investment in constructing telecommunications networks requires a large quantity of capital, the management of resources should be efficient and does not lead to the construction of overlapping networks which causes too large unnecessarily high investment costs. The application of infrastructure sharing is aimed at reducing businesses operating costs and construction of the new overlapping networks in relation to telecommunications resources as well as saving space for erecting new telecommunications towers. On top of that, infrastructure sharing is also very vital for expanding the services that can reduce network rollout time among service providers and produces a lot of benefits in various aspects. This particular research is aimed at explaining and analyzing the basic principles of using infrastructure sharing both in the aspects of techniques and business models with the process for establishing telecommunications infrastructure funds featured. This particular research may benefit the construction of knowledge in the telecommunications industry so as to promote the use of resources in the most efficient way.

KEYWORDS: Telecommunications, Tower Co., Infrastructure Sharing, Infrastructure Fund

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Original Article

INTRODUCTION

In general principle, telecommunications regulators will have the strategies that support and promote mobile network infrastructure sharing with the aim of promoting efficient telecommunications resources sharing and encouraging competition so as to provide consumers with high-quality services. The essence of notification defines that every license holder must be open to allow mobile network infrastructure sharing through formulating the proposal for using infrastructure in the absence of the terms and conditions that discriminate, segregate, create barriers to other operators, disadvantage consumers, but the amount of compensation that is fair, affordable, and unbiased has to be determined. Besides, any license holders cannot obstruct other license holders from using the infrastructure without any reasonable grounds or formulate the terms and conditions that create barriers to infrastructure sharing and emergence of new operators [1].

Infrastructure sharing is another channel that the state uses in raising funds, bringing about infrastructure: mostly of high-value capital which might be in the form of setting up infrastructure funds for investment. Moreover, it also increases the role of the capital market in being a channel for raising funds to support state agencies and to provide more interesting investment options for investors or state enterprises to operate through owing or managing the infrastructure that actually exists. This will not be considered the sale of state enterprise assets but the use of potential in generating income and making future profits from such infrastructure.

In addition, infrastructure sharing also encourages private sector funding apart from listing companies on the Stock Exchange or borrowing money from financial institutions. Private companies can seek funding through raising money for their own infrastructure invested so as to develop other kinds of infrastructure under appropriate costs or using the assets or profitability of the program as the fundraising tools.

Physically, infrastructure sharing helps save the shared space for erecting telecommunications poles. This makes space utilization become efficient without blocking the landscape. It also helps reduce recurring expenses and costs of operators accordingly. As the operators have low investment costs, the consumers will generally receive services at fair prices.

The telecommunications infrastructure for mobile networks shared both interior and exterior of a building is displayed in figure 1.

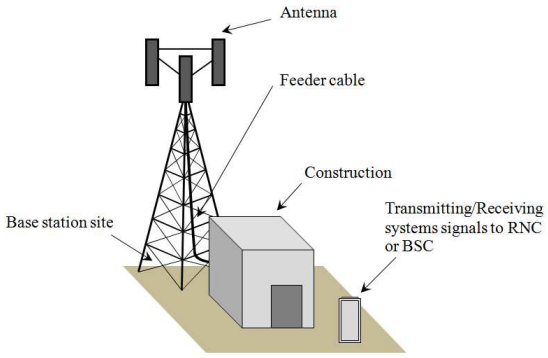

Figure 1: Base Station Components

Components of a Base Station Are

- A tower or mast for antenna installation
- Base station site
- The building, construction or container for installing base station equipment, including equipment for power supply, air-conditioning system, security system, and other facilities
- The feeder cable for the base station located inside and outside buildings
- The antenna system for the base station located inside and outside buildings
- The Transmitting/Receiving systems between the base station and base station controllers such as radio node controllers (RNC) and base station controller (BSC) in the forms of a wired system, frequency system, light system, other electromagnetic systems, and any particular systems or the combination of several systems [7].

INFRASTRUCTURE SHARING BUSINESS MODELS

The forms of company establishment to take ownership of telecommunications infrastructure assets are as the following [7]:

- A single company provides network infrastructure sharing services at middle prices through surveying the locations and needs of every operator without bias.

- A central company of the infrastructure fund type is a form of mutual funds established to raise money from general investors: both retail and institutional, with the aim of making investment in the infrastructure broadly beneficial to public interest. This particular fund can help reduce the burden on capital budgeting and public debt created by the public sector. It is also a fundraising option for the private sector to develop such infrastructure. The owners of infrastructure assets who need to raise money through infrastructure funds have to make contact with an asset management company (AMC).
- State telecom enterprises put their telecommunication towers into network sharing service in the form of "Tower Co". The rental telecommunications tower is another option for establishing the "Tower Co" which can connect with the fiber-backbone to generate motivations for mobile phone and broadband service providers; both to seek for providing voice and broadband services in shortage areas through various business models worldwide. The towers will have already been installed for these tower companies and the operators can only submit rental registration for towers in the area of interest. Such Tower Co businesses have already been available overseas.

The principle of infrastructure sharing gains widespread acceptance in various countries where telecommunications development has been undergone such as USA, Puerto Rico, China, and Italy. It is found that there are many telecommunications tower rental companies available for mobile phone providers such as The Mid-Atlantic Broadband Co-operative or MBC of which the towers cover the whole area of the Virginia State. The MBC was founded in 2,000 with the aim of reliving the severity of social and economic crises arisen from changes in global economic conditions. While other industries had shut down affecting employees to lose their jobs, the MBC saw that the geographical position of Virginia's rural areas has never experienced much competition in telecommunications services, the rate of service prices is high, and the incumbent operators have had no plan to expand widespread broadband access in the region. According to the aforementioned reasons, the MBC erected the telecommunications towers connecting to the fiber-backbone in order to generate the motivations that drive mobile phone and broadband operators in seeking to provide both voice and broadband services in shortage areas. Nowadays, the MBC is considered extremely successful with telecommunications towers available for rent. For example, the towers in Southern Virginia are designed to support the needs of wireless broadband and Internet, microwave backhaul, and emergency communication service providers other than mobile phone services. The mean of rental agreement on MBC's towers is month-to-month, furnished with the equipment and areas for installing communications containers and other related facilities [8].

The countries that undergo infrastructure sharing are numerous worldwide and can be exemplified in table 1.

Table 1: Exemplify the Countries Making Infrastructure Agreements on the Telecommunications Industry [1]

Country (Operators)	Details
Sweden March 2001 (Tele2 and Telia)	The two operators agreed to set up a joint venture company and deploy a nationwide 3G network. As of 2005, they had one of the largest shared 3G networks in the global telecom industry.
Sweden May 2001 (Hi3G and Europolitan)	The joint venture was tasked to deploy a 3G network covering the 70 percent of population outside major cities. Orange later joined the joint venture.
Germany and the United Kingdom June 2001 (BT and Deutsche Telekom)	The two operators agreed to share parts of their 3G networks. The main outcome was a roaming deal in the UK between BT Cellnet and One2One in small cities and rural areas.

Table 1: Contd.,	
Spain October 2003 (Telefónica and Yoigo)	The two operators agreed on an infrastructure-sharing deal for both urban and rural areas.
Australia August 2004 (Hutchison 3G Australia and Telstra)	The two operators agreed on network sharing and committed to joint ownership and operation of H3GA's existing 3G radio access network.
Spain November 2006 (France Telecom (Orange) and Vodafone)	The agreement focused on rural areas with fewer than 25,000 inhabitants. The agreement is expected to reduce costs by as much as 40 percent.
India February 2007 (Hutchison Essar and Bharti Airtel)	Vodafone (Hutch Essar) and Bharti entered into an MOU covering a comprehensive range of infrastructure-sharing options in India. A regulatory proposal to further share infrastructure throughout India followed in April 2007.
United Kingdom February 2007 (Orange and Vodafone)	The two operators announced plans to share their radio access network across the United Kingdom.
International February 2007 (T-Mobile)	T-Mobile indicated intent to focus on network sharing as a growth strategy but excluded the United Kingdom from its plans.
Spain July 2007 (Telefónica and Yoigo)	Five-year renewal of the 2003 contract.

Generally, utilization fees depend on the agreements made among license holders. However, if some disputes occur, the disputant can ask the regulator to make a final decision on the issue. In order to expose related information to the public, the announcement should specify the list of telecommunications infrastructure for mobile network sharing, i.e. the antenna system, feeder cable, tower for installing the antenna, construction or building, base station area, and system transmitting signals between the base station to the radio node controllers (RNC) and base station controller (BSC) so as to prevent diverse interpretations on what are counted as the telecommunications infrastructure for mobile network sharing.

These tower companies will play a major role in driving network roll-out among operators. Meanwhile, they also provide a higher chance for small operators to become participants in telecommunications markets.

Efficient management of telecommunications resources varies among countries depending on individual markets. Another approach to telecommunications resources management is as the following.

The encouragement that gives rise to telecommunications facility service providers will result in fair competition and efficient use of telecommunications resources. It also reduces recurring investments which can lead to cost reduction among telecommunications service providers and the consequences of more benefits and better access to service users [3]. For example, due to a lot of recurring telecommunications tower investments or duplicate wiring of optic fibers nowadays, the encouragement to bring about telecommunications facility service providers in the form of Tower Co or the central company servicing only mobile towers will promote service providers to use the service of Tower Co instead of constructing duplicates of telecommunications towers.

"Telecommunication facilities" refer to the essential facilities which are determined to be used as the elements for providing telecommunications services and can be classified as follows:

- Elements of the telecommunications passive facility type can be classified into 2 aspects [2] :

Civil engineering includes the construction (shelter, structure, and container), building, electrical power system, electrical lighting system, security system, alarm system, other facilities, etc.

Non electronic element of telecommunications network includes the antenna, dark fiber optic, duct, and tower, etc.

- Elements of the telecommunications active facility type in the aspect of electronic element of telecommunications network include signal transmission equipment, base station equipment, base station controllers (RNC, BSC), switching equipment (MSC, GGSN, Switching, Multiplexer, Router, Gateway), equipment for storage and management of subscriptions (HLR, VLR, HSS, IN, Charging Solution), etc [4].

An example of telecommunications facilities is tower sharing which has been existed in USA and Europe for a long time. There are investments worth several billions dollars in India due to the belief that tower sharing will maximize business benefits and the utilization of telecommunications [2]. Especially in developing countries, tower sharing can be considered a tool that helps operators access the remote or rural areas where telecommunications is not worth investing. The increasing needs of populations promote the significance of 3G and 4G LTE, but the investment in such technologies places operators under pressure [7]. Tower sharing can greatly reduce capital investment budgets, bringing about positive effects on operators.

The costs in network operation such as renting sites and costs in resources consumption can be reduced through tower sharing.

To adopt tower sharing will reduce costs among operators. Thus, they will have left with enough capital to make investments in new innovations so as to provide the customers with more efficient services.

The tower business can be carried out by 2 different means [2]:

- Inter-operator tower sharing
- Third-party tower companies which can be classified into 2 forms:
  - Joint ventures between operators
  - Third-party vendor tower companies

The strengths and weaknesses of each type can be demonstrated in table 2.

Table 2: Forms of Tower Businesses [2]

Operating Model	Advantages	Disadvantages
Inter-operator tower sharing	• Simple to implement • Tower ownership still lies with the operator leasing out the space	• Normally limited to sharing of towers owned by the respective operators • Dependency of lessee on lessor
Joint Venture (JV) (for assets) between operators	• Reduces operational risk and provides full visibility to working of tower companies • Easy to finance as operators only need to transfer assets into the JV • Margins of tower companies less of an issue.	• Difficulties in coordinating operations teams (both companies have equal representation on JV, which makes all the purchase decisions) • How to coordinate and agree rollout of new towers • Typically not suitable for more extensive sharing (eg, radio access network transmission and backhaul).
Vendor-led network sharing and operations and maintenance outsourcing	• Higher savings from consolidation of assets, operations, and teams • Vendors typically guarantee a certain level of savings from outsourcing and from enabling sharing • Transformation risk transferred to vendor • Third party can provide objective avenue for resolving issues.	• Reliance on third-party vendor • Reduced control • Partners must share savings with vendor • Simultaneous outsourcing and sharing can destabilize organizations during transition.

GENERAL PRINCIPLES OF INFRASTRUCTURE SHARING

- **Responsibilities of License Holders Include:**
  - Draft a proposal concerning telecommunications infrastructure sharing in conformity to the criteria and methods determined by the regulate sector.
  - Inform other license holders who request for infrastructure sharing about necessary and correct information so that they can manage themselves to reach infrastructure sharing upon requests.
  - Open negotiations to help make agreements on the terms and conditions of licenses for telecommunications infrastructure sharing with honorable intention.
  - Facilitate other license holders in accessing their own telecommunications infrastructure.
  - Never carry out any executions that monopolize, reduce or restrict telecommunication infrastructure sharing.
  - Never carry out any executions that discriminate license holders who request for telecommunications infrastructure sharing.
- **License Holders May Reject the Sharing of their Own Infrastructure by other Operators in Case:**
  - The existing infrastructure is not adequate for allowing infrastructure sharing with other operators.
  - Infrastructure sharing poses the technical problems that may disturb or disrupt telecommunications. In this case, license holders who deny mobile phone infrastructure sharing with other operators must be responsible for explaining and identifying the reasons behind such rejection.
- **The Fees for Infrastructure Sharing Will be Based on the Agreements Made among License Holders. They should be Fair, Reasonable, and Indiscriminate.**
- **The Proposals for Telecommunications Infrastructure Sharing must be Presented in the form of Documents Stating Intentions to use Telecommunications Services. They Should Include at Least the following Details**
  - List of names and details about telecommunications infrastructure, terms and conditions of infrastructure sharing as well as the process and duration of negotiating agreements on telecommunications infrastructure sharing
  - Explicit regulations and technical details of infrastructure sharing
  - The process and method of telecommunications infrastructure sharing
  - Details of buildings, locations, sites for equipment installation, public utilities, and other facilities necessarily required for telecommunications infrastructure sharing
  - Fees for using telecommunications infrastructure sharing
  - Regulations on roles and responsibilities of the license holders who request for telecommunications infrastructure sharing and who provide telecommunications infrastructure sharing as well as the terms and conditions of keeping secrets and revealing the information and security measures.

- Conditions and procedures in case the expansion, increase or reduction of telecommunications infrastructure usage is required and in case there are some changes in the existing telecommunication infrastructures
- Procedures, methods, and durations for operators to allow telecommunications infrastructure sharing over the complaints and arguments of the license holders who request for using telecommunications infrastructure
- Sanctions for breach of license conditions

- **The Proposal for Telecommunication Infrastructure Sharing must be Absent from the following Features**
  - The conditions that discriminate, segregate or obstruct other licensed operators
  - Irrational conditions which may cause monopolization, reduction or restriction on telecommunications services
  - The fees for telecommunications infrastructure sharing that are unfair, unreasonable, or discriminatory
- **Procedures and Processes of Negotiations on using Telecommunication Infrastructure Sharing**

The license holders who will request for telecommunications infrastructure sharing must honorably submit to the licensed operators providing telecommunication infrastructure sharing the explicit letter of intent which exposes the desire for entering into a contract for telecommunications infrastructure sharing according to the terms and conditions imposed in the proposal for telecommunications infrastructure sharing.

License holders will never carry out each of the following executions:

- Reject others to access telecommunication infrastructure sharing without any rational-legal bases.
- Neglect, be dilatory or cause delay in negotiations or entering into the contract for telecommunications infrastructure sharing.
- Reject to reveal the correct data information necessary for telecommunications infrastructure sharing
- Impose the regulations on telecommunications infrastructure sharing that obstruct telecommunications infrastructure sharing

The license holders who provide telecommunications infrastructure sharing and who request for telecommunications infrastructure sharing must make negotiations on using the telecommunications infrastructure together according to the proposal for telecommunications infrastructure sharing among the license holders who offer telecommunications infrastructure sharing. Based on this, the day when the license holders offering telecommunications infrastructure sharing receive the letter of intent for telecommunications infrastructure sharing is considered the start date of negotiations.

The contract for telecommunication infrastructure sharing must imposes the explicit roles and responsibilities between partners of the contract. They must not disadvantage service users, discriminate, segregate or obstruct other license holders, and must be absent from the regulations or conditions that monopolize, reduce, or restrict telecommunications infrastructure sharing or free and fair competition.

INFRASTRUCTURE FUNDS

Infrastructure funds are a type of mutual funds aimed to raise money from general investors: small and institutional so as to make investments in the infrastructure beneficial to public interest. Such infrastructure is vital and beneficial to the development of the country and requires high investment capital. Infrastructure funds, therefore, help reduce the burden on capital budgeting and public debt created by the public sector. It is also a fundraising option of the private sector to develop such infrastructure. The types of investment funds on infrastructure can be shown in table 3.

Table 3: Types of Investment Funds on Infrastructure

Examples of Infrastructure Funds 10 Infrastructure Businesses in which Investments can be Made	
Rail transport system	Electricity
Water supply	Street, Expressway or Concession highways
Aerial port or Airport	Deep sea port
Telecommunications	Alternative energy
Water management system/ Irrigation	Natural disaster prevention system

`Infrastructure funds are a type of mutual funds mainly for making investments in telecommunications infrastructure. The assets to telecommunications infrastructure in which the funds can make investments are of the following 2 main types:

- Passive assets include the tower, fiber optic, etc [2].
- Active assets include signal transmission equipment and signal receiver-transmitter installed on telecommunications towers. Such infrastructure is vital for utilization of telecommunication devices such as mobile phones and tablet computers [4].

Such infrastructure can support general utilization of telecommunications such as receiving and transmitting mobile phone signals: both in the forms of voice or data via mobile phones and tablet computers, etc. Nowadays, the telecommunications operators who are major mobile phone service providers in the country tend to set up their own telecommunications networks, including the tower, fiber optic, signal receiver and transmitter, and other facilities. As a real, the operators can share the telecommunication infrastructure among each other, for example, one tower can support 4-8 telecommunications operators [4] [6].

The setup of telecommunications infrastructure can be compared as the campaign that promotes telecommunications infrastructure sharing among operators, affecting them to take the most advantage out of the existing assets. It also enables the development of networks to provide consumers with telecommunications services even if the operators do not have their own towers or network equipment as well as reduces recurring investments and negative effects on the environment. The unit holders of such telecommunication infrastructure funds will earn the returns from allowing operators to rent telecommunications infrastructure assets for operating their own telecommunication businesses or from taking advantages form telecommunications infrastructure assets in other forms as permitted by laws on securities.

Benefits of infrastructure funds on the public and private sectors include [2][5][9]:

- Benefits to the public sector: Infrastructure funds are a channel for the public sector to raise money. Generally, infrastructure businesses mostly require high investment capital. The approach to raising money through

establishing infrastructure funds to make investments in revenue streams or the rights to manage the benefits gained from infrastructure businesses will not result in public debts and the state enterprises can still retain ownership and manage infrastructure businesses. Therefore, it is not considered the sale of state enterprise assets but the use of potential demonstrated to generate revenues and make future profits from infrastructure businesses.

- Moreover, it also increases the role of capital markets in raising money for public enterprises and provides more interesting options for general investors.
- Benefits to the private sector: Infrastructure funds are considered another channel for the private sector to raise money aside form listing companies on the Stock Exchange or borrowing money from financial institutions. Private companies can seek funding through raising money for their own infrastructure invested in order to develop other kinds of infrastructure at appropriate costs or using the assets or profitability of the program as the fundraising tools.

In order to set up infrastructure funds, the owners of infrastructure assets who need to raise money through infrastructure funds have to make contact with an asset management company (AMC). The AMC will arrange to have financial consultants help analyze and study the possibility of setting up the funds, examine and verify (carry out Due Diligence) the infrastructure assets to be invested in, and help draw up documents to grant an approval for setting up the funds form Stock Exchange regulatory authorities and other related documents as follows:

Details of the program to set up funds

Commitments between unit holders and the AMC

Contracts for appointing fiduciaries

General procedures for sending requests for setting up Asset Management Company (AMC) funds must include an arrangement to get financial consultants to help supply the management program and prospectuses of infrastructure funds. The process of setting up infrastructure funds is shown in figure 2.

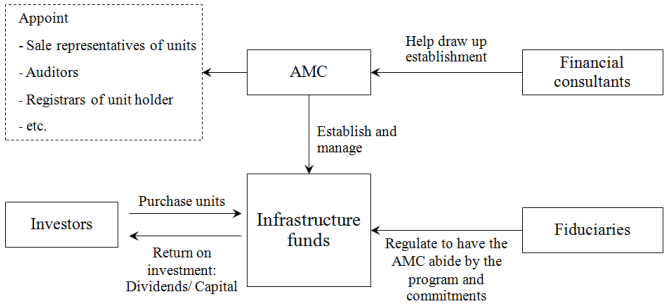

Figure 2: The Process of Setting up Telecommunications Infrastructure Funds

CONCLUSIONS

Nowadays, the telecommunication industry is seeking for the solution for reducing network investments and the telecommunications regulators worldwide tend to implement some measures to encourage and promote infrastructure sharing. This particular research is imparted with it the benefits gained from carrying out telecommunications infrastructure sharing: both in the form of Tower Co or infrastructure funds, etc. This research also proposes basic principles and processes of setting up the funds for telecommunications infrastructure sharing among operators. It will be

beneficial to the telecommunications industry in using national resources efficiently so as to yield the maximum benefit to the country.

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